
UNIT 17 ENVIRONMENT AND SUSTAINABLE PRACTICES

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17.0 OBJECTIVES

After reading this Unit You will be able to understand-

- Waste & Its Types
- Techniques for Waste Disposal
- Techniques for Waste Minimization
- Management of Hazardous wastes
- Rain Water Harvesting
- Pollution and its types
- Ways for Pollution Control
- Various Laws & Permits

17.1 INTRODUCTION

We all are aware that how waste is generated in our homes, Industries, Restaurants etc. and how it is disposed of. The disposal of waste has been done poorly since ages, be it in villages, towns, cities or metropolitans. Nowadays, with increase in the population, the generation and disposal of waste has become matter of concern. In fact, waste management has emerged as a serious challenge having major implications not only for human health and social life but also for the environment. In this chapter we are going to discuss different dimensions of waste management.

17.2 BASIC DEFINITIONS

AEROBIC: - Requiring Air/Oxygen. It is used in reference to decomposition processes that occur with inclusion of Oxygen.

ANAEROBIC: - Not requiring air or oxygen, used in reference to decomposition processes that occur in the absence of oxygen.

BIODEGRADABLE: - Capable of breaking down through the action of bacteria.

FOSSIL FUELS: - Coal, natural gas, liquefied petroleum gas, and fuels derived from crude oil (including petrol and diesel). They are called fossil fuels because they have been formed over long periods of time from ancient fossilised organic matter.

GREEN POWER: - Electricity generated from clean, renewable energy sources (such as solar, wind, biomass and hydro power) and supplied through the grid network by your electricity supplier

GREENHOUSE GASES: - Gaseous constituents of the atmosphere, both natural and from human activity, that absorb and re-emit infrared radiation. Water vapor (H₂O) is the most abundant greenhouse gas. Greenhouse gases are a natural part of the atmosphere

INCINERATION: - Combustion (by chemical oxidation) of waste material to treat or dispose of that waste material.

NON- BIODEGRADABLE: - Waste which cannot be decomposed or broken down.

17.3 WASTE & ITS TYPES

There are different types of wastes which are collected from different areas of the hotels for further disposing and processing so that it can not lead to any kind of pollution to the environment.

- SOLID WASTES
- LIQUID WASTES

17.3.1 TYPES OF SOLID WASTE

NON - BIODEGRADABLE:

- Unlike biodegradable wastes, non-biodegradable cannot be easily handled.
- Non-biodegradable wastes are those who cannot be decomposed or dissolved by natural agents.
- They remain on earth for thousands of years without any degradation. Hence the threat caused by them is also more critical.
- A notable example is the plastics which are a commonly used material in almost every field.

- To give these plastics a long-lasting effect, improved quality plastics are being put to use. This made them more temperature resistant and more durable even after use.
- Other examples are cans, metals, and chemicals for agricultural and industrial purposes. They are the main causes of air, water and soil pollution and diseases like cancer.

17.3.2 SOLID WASTE MANAGEMENT

Solid waste management consists of wastes which are either dry or wet waste which needs to be disposed of, without affecting our environment. Following methods and Machinery are used for disposing solid wastes in Hotel. They are:-

INCINERATER

Incineration is a disposal method that involves combustion of waste material. Incineration and other high temperature waste treatment systems are sometimes described as "thermal treatment". Incinerators convert waste materials into heat, gas, steam, and ash. Incineration is carried out both on a small scale by individuals and on a large scale by industry. It is used to dispose of solid, liquid and gaseous waste. It is recognized as a practical method of disposing of certain hazardous waste materials (such as biological medical waste). Incineration is a controversial method of waste disposal, due to issues such as emission of gaseous pollutants. Incineration is common in countries such as Japan where land is scarcer, as these facilities generally do not require as much area as landfills. Waste-to-energy (WtE) or energy-from-waste (EfW) is broad terms for facilities that burn waste in a furnace or boiler to generate heat, steam and/or electricity. Combustion in an incinerator is not always perfect and there have been concerns about micro-pollutants in gaseous emissions from incinerator stacks. Particular concern has focused on some very persistent organics such as dioxins which may be created within the incinerator and which may have serious environmental consequences in the area immediately around the incinerator. On the other hand this method produces heat that can be used as energy.

PULVERIZER

The waste is simply pulverized into powder without changing its chemical composition. They are either used as powdered manure or discharged through sewer line.

MECHANICAL COMPOST MACHINE

The plant converts garbage into manure that is rich in nitrogen contents. This is the most hygienic method of waste disposal.

LANDFILL

Disposing of waste in a landfill involves burying the waste, and this remains a common practice in most countries. Landfills were often established in abandoned or unused quarries, mining voids or borrow pits. A properly-designed and well-managed landfill can be a hygienic and relatively inexpensive method of disposing of waste materials. Older, poorly-designed or poorly managed landfills can create a number of adverse environmental impacts such as wind-blown litter, attraction of vermin, and generation of liquid Leachate.

Another common byproduct of landfills is gas (mostly composed of methane and carbon dioxide), which is produced as organic waste breaks down anaerobically. This gas can create odor problems, kill surface vegetation, and is a greenhouse gas. Design characteristics of a modern landfill include methods to contain leachate such as clay or plastic lining material. Deposited waste is normally compacted to increase its density and stability, and covered to prevent attracting vermin (such as mice or rats). Many landfills also have landfill gas extraction systems installed to extract the landfill gas. Gas is pumped out of the landfill using perforated pipes and flared off or burnt in a gas engine to generate electricity.

CONTROLLED TIPPING

This method is employed where land is available for redevelopment. Waste is tipped from dumper into hollow spaces in the ground about 4 to 7 feet deep and then buried under ground.

RECYCLING METHODS

The popular meaning of 'recycling' in most developed countries refers to the widespread collection and reuse of everyday waste materials such as empty beverage containers. These are collected and sorted into common types so that the raw materials from which the items are made can be reprocessed into new products. Material for recycling may be collected separately from general waste using dedicated bins and collection vehicles, or sorted directly from mixed waste streams. The most common consumer products recycled include aluminum beverage cans, steel food and aerosol cans, HDPE and PET bottles, glass bottles and jars,

paperboard cartons, newspapers, magazines, and corrugated fiberboard boxes. PVC, LDPE, PP, and PS (see resin identification code) are also recyclable, although these are not commonly collected. These items are usually composed of a single type of material, making them relatively easy to recycle into new products. The recycling of complex products (such as computers and electronic equipment) is more difficult, due to the additional dismantling and separation required.

17.3.3 LIQUID WASTES

BOD

Biological Oxygen Demand is the amount of dissolved oxygen needed (Demanded) by aerobic microorganism required for oxidation/breakdown of biodegradable wastes in a given water sample at a given temperature for a specific time period. The BOD value is most commonly expressed in milligrams of oxygen consumed per litre of sample during 5 days of incubation at 20 °C.

In India, Environment Protection act 1986 has set a BOD of 375 mg/litre of water. However NGT has limit BOD of 75 mg/litre of water for Hotels & Restaurants.

SEWAGE TREATMENT PLANT

As the sewage becomes stale, it begins to cause nuisance. The method of sewage disposal are broadly divided into two:-

- DISPOSAL BY DILUTION
- BY PURIFICATION

BY DILUTION

In this raw sewage is thrown into a large body of natural waters. In due course of time it is purified by the self purification capacity of the natural waters.

BY PURIFICATION

- **LAND TREATMENT**- The sewage waste waters through spraying is spread in open textured soil fields. A part of waste water evaporates and the remaining portion percolates.

- **CHEMICAL TREATMENT** - In this method sewage water is treated with certain chemicals like Lime and Alum or ferrous hydroxide. The colloidal materials precipitates as well as bad odour is removed.
- **SEPTIC TANK/ANAEROBIC TANKS** – It is plain sedimentation tank in which the bio chemical reaction by anaerobic bacteria takes place . During the detection period the sewage is purified and the effluent is taken to soak pits for disposal. The septic tanks are provided with cover as the bad smell occurs during digestion period.
- **BIO AERATION METHOD/ACTIVATED SLUDGE METHOD**- This aerobic method is most efficient. The sewage is first passed through the rough screens to get rid of the gross solids. The sewage is treated in aerated tanks with the compressed air. The disoriented sewage is passed through the grease collecting chamber. The air is forced in by diffuses in the final chamber. The sludge settles down at the bottom of settling tank.
- **LAGOONING** :- Running wastewaters into shallow artificial ponds with or without other treatments. The wastes are decomposed slowly until liquid part can be run into stream or other body during the rainy season or at the time of melting snow, when there is good volume of water. Usually NaNO_3 is added to reduce odours.

17.4 WASTE MINIMIZATION

Techniques to keep waste generation at a minimum level in order to divert materials from landfill. The term waste minimisation is also applied to recycling and other efforts to reduce the amount of waste going into the waste stream. In other words, Waste minimization means reducing waste at source. In general, this means practices such as:

- Reusing (or promoting the reuse of) materials in their original form as far as possible
- Separating waste into different streams at source, before it is collected for recovery and recycling purposes
- Diverting waste from landfills through appropriate mechanisms and facilities
- Facilitating the processing or treatment of any recyclable waste, in an economical and environmentally sustainable manner.

Check Your Progress 1

Q.1 What is waste? What are the types of waste?

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Q.2 What are the methods of handling Solid Waste?

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Q.3 Briefly Explain BOD?

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Q.4 What is the difference between Biodegradable & Non-Biodegradable wastes?

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17.5 HAZARDEOUS SUBSTANCE MANAGEMENT

Hazardous waste is waste that poses substantial or potential threats to public health or the environment. What determines whether it's a hazardous waste is it's:

- ignitability (i.e., flammable)
- reactivity
- corrosivity
- toxicity

Major services include waste collection, treatment, and disposal; remediation; and recycling. Waste collection accounts for about 55 percent of industry revenue; treatment and disposal, 20 percent; and remediation, 15 percent. (Remediation involves the cleaning of crude oil spills and ground contamination, removal of asbestos and lead paint, and restoration of strip-mined areas.) Small companies usually operate in only one of these segments. Larger companies often have vertically integrated operations that include all of these components.

17.5.1 E-WASTE

E-waste consists of dismantled parts of computers, electronic appliances, mobile phones, TV, floppy discs, pen drives. In India E-wastes are dumped into unsafe and unauthorised dumping yards where they are dismantled manually and unscientifically, causing great environmental and health risks as they contain dangerous contaminants.

17.6 RAIN WATER HARVESTING

Water harvesting is the activity of direct collection of rainwater, which can be stored for direct use or can be recharged into the groundwater. Water harvesting is the collection of runoff for productive purposes. As water harvesting is an ancient tradition and has been used for millennia in most dry lands of the world, many different techniques have been developed. However, the same techniques sometimes have different names in different regions and others have similar names but, in practice, are completely different.

17.6.1 BENEFITS OF WATER HARVESTING

Benefits of rain water harvesting system:

- Rainwater is a comparatively clean and totally free source of water.
- Rainwater is improved for scenery plants and gardens because it is not chlorinated.
- It can supplement other sources of water supply such as groundwater or municipal water connections.
- It lowers the water supply cost.
- It can provide an excellent back-up source of water for emergencies.
- It is socially acceptable and environmentally responsible.
- It uses simple technologies that are inexpensive and easy to maintain.
- Reduced flood flows and topsoil loss.
- It is free; the only cost is for collection and use.
- It reduces the contamination of surface water with sediments, fertilizers and pesticides from rainwater run-off resulting in cleaner lakes, rivers, oceans and other receivers of storm water. It is used in those areas which face insufficient water resources.
- It is good for laundry use as rainwater is soft and lowers the need for detergents.
- It can be used to recharge groundwater. It minimizes the runoff which blocks the storm water drains.

17.6.2 NEED FOR WATER HARVESTING

- As water is becoming scarce, it is the need of the day to attain self-sufficiency to fulfill the water needs.
- As urban water supply system is under tremendous pressure for supplying water to ever increasing population.
- Groundwater is getting depleted and polluted.
- Soil erosion resulting from the unchecked runoff.
- Health hazards due to consumption of polluted water.

17.6.3 METHODS OF WATER HARVESTING

- Rainwater stored for direct use in above ground or underground sumps / overhead tanks and used directly for flushing, gardening, washing etc. (Rainwater Harvesting).
- Recharged to ground through recharge pits, dug wells, bore wells, soak pits, recharge trenches, etc. (Ground water recharge)

17.7 POLLUTION

The term Pollution is derived from latin word pollutes. Pol means before and lutus means wash. In general pollution means the conditions disturbing to the balance of natural environment in such a way that its beneficial use is affected adversely.

17.7.1 TYPES OF POLLUTION

17.7.1.1 AIR POLLUTION

Air pollution is a mixture of solid particles and gases in the air. Car emissions, chemicals from factories, dust, and pollen and mold spores may be suspended as particles. Ozone, a gas, is a major part of air pollution in cities. When ozone forms air pollution, it's also called smog. Some air pollutants are poisonous. "Air pollution occurs when harmful or excessive quantities of substances are introduced into Earth's atmosphere. Sources of air pollution

include gases, particulates, and biological molecules.” “Air pollution refers to the release of pollutants into the air that are detrimental to human health and the planet as a whole.”

Primary and secondary air pollutants:

A primary pollutant is an air pollutant emitted directly from a source.

A secondary pollutant is not directly emitted as such, but forms when other pollutants (primary pollutants) react in the atmosphere.

Primary air pollutants:

The primary pollutants are “directly” emitted from the processes such as fossil fuel consumption, volcanic eruption and factories. The major primary pollutants are Oxides of Sulphur, Oxides of Nitrogen, Oxides of Carbon, Particulate Matter, Methane, Ammonia, Chlorofluorocarbons, Toxic metals etc.

Examples of Primary Pollutants:

1. Car exhaust, smokestacks (CO, SO₂, NO)
2. Particulate material (soot, ash)
3. Toxic metals (lead, mercury)
4. Volatile organic compounds (VOCs) (methane, propane, CFCs, etc.)

Secondary Air pollutants:

The secondary pollutants are not emitted directly. The secondary pollutants form when the primary pollutants react with themselves or other components of the atmosphere. Most important secondary level Air Pollutants are Ground Level Ozone, Smog and POPs (Persistent Organic Pollutants).

17.7.1.1.1 CAUSES OF AIR POLLUTION:

The burning of fossil fuels Sulphur dioxide emitted from the combustion of fossil fuels like coal, petroleum and other factory combustibles are one the major cause of air pollution. But, their overuse is killing our environment as dangerous gases are polluting the environment

- **Burning of Fossil Fuels:** The combustion of fossil fuels emits a large amount of sulphur dioxide. Carbon monoxide released by incomplete combustion of fossil fuels also results in air pollution.

- **Automobiles:** The gases emitted from vehicles such as jeeps, trucks, cars, buses, etc. pollute the environment. These are the major sources of greenhouse gases and also result in diseases among individuals.
- **Agricultural Activities:** Ammonia is one of the most hazardous gases emitted during agricultural activities. The insecticides, pesticides and fertilizers emit harmful chemicals in the atmosphere and contaminate it.
- **Factories and Industries:** Factories and industries are the main source of carbon monoxide, organic compounds, hydrocarbons, and chemicals. These are released into the air degrading its quality.
- **Mining Activities:** In the mining process, the minerals below the earth are extracted using large pieces of equipment. The dust and chemicals released during the process not only pollute the air but also deteriorate the health of the workers and people living in the nearby areas.
- **Domestic Sources:** The household cleaning products and paints contain toxic chemicals that are released in the air. The smell from the newly painted walls is the smell of the chemicals present in the paints. It not only pollutes the air but also affects breathing.

17.7.1.1.2 EFFECTS OF AIR POLLUTION:

The hazardous effects of air pollution on the environment include:

- **Diseases:** Air pollution has resulted in several respiratory disorders and heart diseases among humans. The cases of lung cancer have increased in the last few decades. Children living near polluted areas are more prone to pneumonia and asthma.
- **Global Warming:** Due to the emission of greenhouse gases, there is an imbalance in the gaseous composition of the air. This has led to an increase in the temperature of the earth. This increase in earth's temperature is known as global warming.
- **Acid Rain:** The burning of fossil fuels releases harmful gases such as nitrogen oxides and sulphur oxides in the air. The water droplets combine with these pollutants, become acidic, and fall as acid rain which damages human, animal and plant life.

- **Ozone Layer Depletion:** The release of chlorofluorocarbons (CFC), halons, and hydrochloro fluorocarbons in the atmosphere is the major cause of depletion of the ozone layer. The depleting ozone layer does not prevent the harmful ultraviolet rays coming from the sun and causes skin diseases and eye problems among individuals.
- **Effect on Animals:** The air pollutants suspend on the water bodies and affect the aquatic life. Pollution also compels the animals to leave their habitat and shift to a new place.

17.7.1.2 WATER POLLUTION & SEWAGE POLLUTION

Water pollution is the contamination of water bodies, usually as a result of human activities. Water bodies include for example lakes, rivers, oceans, aquifers and groundwater. Water pollution results when contaminants are introduced into the natural environment. “Water is essential to life. It need not be spelt out exactly how important it is. Yet water pollution is one of the most serious ecological threats we face today.” Water pollution happens when toxic substances enter water bodies such as lakes, rivers, oceans and so on, getting dissolved in them, lying suspended in the water or depositing on the bed. This degrades the quality of water. Not only does this spell disaster for aquatic ecosystems, the pollutants also seep through and reach the groundwater, which might end up in our households as contaminated water we use in our daily activities, including drinking.

17.7.1.2.1 CAUSES OF WATER POLLUTION:

The causes of water pollution vary and may be both natural and anthropogenic. However, the most common causes of water pollution are the anthropogenic ones, including:

- **Agrochemicals:** Agrochemicals like fertilizers (containing nitrates and phosphates) and pesticides (insecticides, fungicides, herbicides etc.) washed by rain-water and surface runoff pollute water.
- **Storm water runoff:** Carrying various oils, petroleum products, and other contaminants from urban and rural areas (ditches). These usually forms sheens on the water surface.

- Sewage: Emptying the drains and sewers in fresh water bodies causes water pollution. The problem is severe in cities.
- Mining activities: Mining activities involve crushing rocks that usually contain many trace metals and sulfides. The leftover material from mining activities may easily generate sulfuric acid in the presence of precipitation water.
- Industrial Effluents: Industrial wastes containing toxic chemicals, acids, alkalis, metallic salts, phenols, cyanides, ammonia, radioactive substances, etc., are sources of water pollution. They also cause thermal (heat) pollution of water.
- Burning of fossil fuels: the emitted ash particles usually contain toxic metals (such as As or Pb). Burning will also add a series of oxides including carbon dioxide to air and, respectively, water bodies.
- Leaking landfills: May pollute the groundwater below the landfill with a large variety of contaminants (whatever is stored by the landfill).
- Animal waste: Contribute to the biological pollution of water streams. Think of it this way: anything that can cause air pollution or soil pollution may also affect water bodies and cause innumerable ecological and human health issues.

17.7.1.2.2 EFFECTS OF WATER POLLUTION:

The effects of water pollution are varied. They include poisonous drinking water, poisonous food animals (due to these organisms having bio accumulated toxins from the environment over their life spans), unbalanced river and lake ecosystems that can no longer support full biological diversity, deforestation from acid rain, and many other effects. These effects are, of course, specific to the various contaminants..

- Water bodies in the vicinity of urban areas are extremely polluted. This is the result of dumping garbage and toxic chemicals by industrial and commercial establishments.
- Water pollution drastically affects aquatic life. It affects their metabolism, behavior, causes illness and eventual death. Dioxin is a chemical that causes a lot of problems from reproduction to uncontrolled cell growth or cancer. This chemical is bioaccumulated in fish, chicken and meat. Chemicals such as this travel up the food chain before entering the human body.
- The effect of water pollution can have a huge impact on the food chain. It disrupts the foodchain. Cadmium and lead are some toxic substances, these pollutants upon

entering the food chain through animals (fish when consumed by animals, humans) can continue to disrupt at higher levels.

- Humans are affected by pollution and can contract diseases such as hepatitis through faecal matter in water sources. Poor drinking water treatment and unfit water can always cause an outbreak of infectious diseases such as cholera etc.
- The ecosystem can be critically affected, modified and destructured because of water pollution.

17.7.1.3 NOISE POLLUTION

Sound is main means of communication in many animals, including humans. A low sound is pleasant and harmless. A loud, unpleasant or unwanted sound is called as noise. A given sound can appear music to some and noise to others. It depends upon loudness, duration and mood of a person. Noise (La. nausea=seasickness) is physical form of pollution. It is not harmful to air, soil and water but affects the animals including humans. Noise is unwanted sound, that is unpleasant, loud and disruptive. Humans have a hearing range called as audible range. Audible range depends upon frequency and loudness of sound. For a person with normal hearing, frequency ranges from 20 to 20,000 Hz and loudness ranges from 0 to 120 dB. Sound is measured in decibels (dB). A decibel value above 80 is considered to be noise pollution.

17.7.1.3.1 CAUSES OF NOISE POLLUTION

- **Industrialization:** Most of the industries use big machines which are capable of producing noise. Apart from that, various equipment's like compressors, generators, exhaust fans, grinding mills also participate in producing noise.
- **Poor Urban Planning:** In most of the developing countries, poor urban planning also play a vital role. Congested houses, large families sharing small space, parking lots, street noise, honking, commercial zone leads to noise pollution which disrupts the environment of society. **Social Events:** Noise is at its peak in most of the social events. Whether it is marriage, parties, pub, disc or place of worship, people normally defy rules set by the local administration and create nuisance in the area. People play

songs on full volume and dance till midnight which makes the condition of people living nearby pretty worse.

- **Transportation:** Large number of vehicles on roads, aero planes, trains produce heavy noise. The high noise leads to a situation wherein a normal person lose the ability to hear properly. **Construction Activities:** Construction activities like mining, construction of bridges, dams, buildings, stations, roads, flyovers take place in almost every part of the world. These construction activities have to be continued to meet the demand of ever increasing Population. It also creates noise pollution.
- **Household Chores:** We people are surrounded by gadgets and use them extensively in our daily life. Gadgets like TV, mobile, mixer grinder, pressure cooker, vacuum cleaners, washing machine and dryer, cooler, air conditioners are also contributors to the amount of noise that is produced and but many times it affects the quality of life of our neighborhood. **Fireworks:** Firework is a common thing during various fairs, festivals and cultural ceremonies. Apart from air pollution, the intensity of their sound creates noise pollution.
- **Agricultural Machines:** Tractors, thrashers, harvesters, tube wells, powered tillers etc. have all made agriculture highly mechanical but at the same time highly noisy.
- **Defence Equipment and launching of satellites:** A lot of noise pollution is added to the atmosphere by artillery, tanks, launching of rockets, explosions, exercising of military airplanes and shooting practices. Screams of jet engines and launching of satellite, sonic booms have a deafening impact on the ears.
- **Miscellaneous Sources:** The automobile repair shops, market places, schools, colleges, bus stands, and railway stations etc. are other sources of noise pollution.

17.7.1.3.2 EFFECTS OF NOISE POLLUTION

Human response to noise varies from man to man according to age and temperament. It may vary even in the same individual from time to time because of change in health, fatigue and other conditions (Fig). The effects of noise on human beings are as under:-

1) **Auditory effects:** It includes deafness or auditory fatigue.

- Deafness or impaired hearing: Prolonged exposures to noise lead to gradual deterioration of internal ear and subsequently hearing loss or deafness. It may occur due to continuous exposure to noise level of more than 90 dB. It may be temporary or permanent. Explosions or other high intensity sounds can also cause immediate

deafness by rupturing the ear drums or damaging the cochlea. Many time hearing loss is attributed to occupation.

- Auditory fatigue: It is defined as a temporary loss of hearing after exposure to sound. Continuous humming sound such as whistling and buzzing in the ears.

2) **Non auditory effects**: These are:-

- Irritation and annoyance: Noise, sometimes, leads to emotional disturbances and makes people loose their temper. It can interfere with proper rest and sleep. Annoyance seems to increase with the loudness of the sound.
- Work efficiency: It has been observed that noise reduces the efficiency of work.
- Physiological effects: It includes dilation of the pupils, paling of skin, tensing of voluntary muscles, diminishing of gastric secretions, increase in diastolic blood pressure and the sudden injection of adrenalins into blood stream which increases neuromuscular tension, nervousness, irritability and anxieties. It can adversely affect the development of unborn babies.
- Other health effects: Noise is also associated with headache, giddiness, sweating, nausea, fatigue, difficulty in breathing, disturbed sleep pattern, psychological stress.
- Trouble Communicating: High decibel noise can put trouble and may not allow people to communicate freely. Constant sharp noise can give you severe headache and disturb your emotional balance.
- Effect on Animals: Animals rely heavily on sounds to communicate, to find food, avoid predators etc. Pets react more aggressively due to exposure to constant noise. They become disoriented more easily and face many behavioral problems. Overexposure to high intensity of noise affects the hearing ability of many animals. Man-made noise affects mating calls and echolocation. This leads to reduction in survival and reproduction rates. At an ecosystem level, noise pollution could lead to migration of animals. Their migration can affect the crop production. Because many animals such as bats pollinate bananas, peaches, agave and other cash crops.
- Effect on non-living things: The noise booms cause cracks in walls of buildings as well as in hills. Sonic boom can break window panes and buildings.

17.7.1.4 THERMAL POLLUTION

Thermal pollution, sometimes called "thermal enrichment," is the degradation of water quality by any process that changes ambient water temperature. A common cause of thermal pollution is the use of water as a coolant by power plants and industrial manufacturers. Other causes of thermal pollution include soil erosion.

17.7.1.4.1 CAUSE OF THERMAL POLLUTION:

Many human and natural factors contribute to the problem of thermal pollution. The single biggest cause of thermal pollution is probably cooling for industrial machinery and power plants. Water is an excellent, and free, cooling agent. This is why many industrial operations pull in relatively cool water to cool their machinery and let the relatively warm water flow back into the river or lake or sea. Thermal pollution also has some natural causes. Geothermal vents and hot springs introduce excess heat into bodies of water. Soil erosion, deforestation, and runoff from paved areas are other artificial sources of hot water. Deforestation eliminates shade, which exposes the water to sunlight. Water on hot paved surfaces gets hot, then runs off into nearby bodies of water, raising the water temperature. Retention ponds can also be a source of thermal shock because the relatively small and shallow bodies of water can absorb quite a bit of heat energy from the sun. Pumping that water directly into a river, lake, or bay causes a significant temperature increase, just like pouring a hot pitcher of water into a bathtub full of water causes the water to jump a few degrees Fahrenheit.

17.7.1.4.2 EFFECTS OF THERMAL POLLUTION:

The effects of thermal pollution are diverse, but in short, thermal pollution damages water ecosystems and reduces animal populations. Plant species, algae, bacteria, and multi-celled animals all respond differently to significant temperature changes. Organisms that cannot adapt can die of various causes or can be forced out of the area. Reproductive problems can further reduce the diversity of life in the polluted area.

17.7.2 WAYS TO CONTROL POLLUTION

Reduce, Reuse, Recycle and Refuse (4 R's to control Pollution)

We should segregate waste products with a view to reduce, reuse, recycle and refuse.

For most of us, kitchen wastes (fruit peels, vegetables, leftover food, tea leaves) forms a large percentage of the total waste at home. Composting is a common method to reduce the volume of kitchen waste to 'zero waste.' It is also an effective way through which kitchen waste can be recycled back into nature. There are certain items in our garbage that can be reused. reusing discarded items means that instead of dumping them and increasing the load of waste, we can reuse these items. Some examples are given here.

- Items such as plastic containers and pickle bottles can be reused to store other things.
- We can reuse wrapping papers, cardboard boxes and chocolate boxes.
- We can give away old clothes to the needy.
- It is better to use cloth bags instead of plastic bags for shopping.
- Buy products which can be reused such as rechargeable batteries.

Often you may have come across persons (the Kabariwalas) who visit our home, and to whom we sell old newspapers, magazines, bottles, tins, etc. Maybe, you have never thought where these products go, and what happens to them. These products are utilised as raw materials for manufacturing other products. In other words, these products are recycled.

This is actually an important effort, as in this process, we not only reduce the load of garbage, but also conserve natural resources. Some of the common items that can be recycled are: - glass, metals, paper, plastics, cardboard, batteries, cans made of steel and aluminium, rubber, wooden furniture.

While segregating wastes, you will find that there are also a large number of items that cannot be reused or recycled. We must have also noticed that some of these items are non-biodegradable in nature. So what we can do is to reduce unnecessary consumption and purchases. We may also refuse to accept items that are damaging to the environment and human health. Some examples are given below.

- Look for products that do not have elaborate packing.
- Use things judiciously.
- Do not waste food.
- Refuse offer of plastic bags.
- Develop eco-friendly habits.

17.8 LEGAL REQUIREMENTS

- The Air Pollution Control Act was passed in 1981. The motor vehicle act for Controlling Air Pollution (PUC) was passed.
- Oil refineries are being upgraded to produce lead free Petrol.
- Environment protection act (EPA) was passed in 1996.
- All Hotels and industries have to obtain certificate from state pollution board/central pollution board before becoming operational.
- National Green Tribunal (NGT) a statutory Authority created recently which takes care about green belt in India.

17.9 LET US SUM UP

Waste management is the collection of all thrown away materials in order to recycle them and as a result decrease their effects on our health, our surroundings and the environment and enhance the quality of life. Waste management practices differ for developed and developing nations, for urban and rural areas, and for residential and industrial producers. Waste Management flows in a cycle: monitoring, collection, transportation, processing, disposal or recycle. Through these steps a company can effectively and responsibly manage waste output and their positive effect they have on the environment. Waste generation per capita has increased and is expected to continue to climb with growing population, wealth, and consumerism throughout the world. Approaches to solving this waste problem in a scalable and sustainable manner would lead us to a model that uses waste as an input in the production of commodities and value monetized, making waste management a true profit center.

Check Your Progress 2

Q.1 What are E- Waste?

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Q.2 List down the Benefits of Rain Water Harvesting.

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Q.3 Explain different types of pollution in brief?

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Q.4 Enumerate 4R's for controlling pollution.

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